

Cell Communication Project

Communication between cells is important in order to ensure that all cells are performing their required functions. Cell to cell communication usually takes the form of a signal transduction pathway. You can think of such a pathway as a row of dominoes, all standing on their ends. Push one domino over, and the rest fall, due their direct or indirect association with the first one you pushed over. Some signals that cells send only work over a short distance. For example, in the brain, neurotransmitters allow one neuron to excite its neighbor. The signal travels no further. Other signals, however, do travel a further distance. Hormones, for example, are secreted by a source organ and travel to target cells, equipped with specialized receptors, in remote regions of the body. Immune cells such as B cells and T cells also use cell signals to communicate with foreign antigens. Even plants use cell signaling to communicate between cells! Cell signaling allows both plants and animals to coordinate physiological responses to their external and internal environments. Sometimes signal transduction might go awry. Because there are so many players and so many steps in the process, it is easy to see how this might happen. Faulty cell communication pathways often result in disease or even death of an organism. This project will look at how cell communication works in a variety of cells.

Project: Investigate one specific example of a cell communication pathway.

Provide context for your *specific topic* by explaining how cell signal pathways work in general. Begin with the resources that accompany your book. Chapter 11 in your textbook is an excellent starting point. You may then extend your research to include websites such as Bozeman Biology or Genetic Science Learning Center to help you with the background information. Additional internet resources are listed at the end of this sheet. Your general background information will make up the introduction section of your project and should include information about:

- The three stages of a signal transduction pathway.
- The methods of local and long distance signaling.
- How plants and animals affect neighboring cells *directly*?
- What is a ligand, and what part does it play in signal transduction?
- G protein linked receptors, tyrosine kinase receptors, and gated ion channels, and intracellular receptors are all used in the *reception* part of the signal transduction pathway. In easy to understand language, choose **one** of these pathways and explain how it works.
- What is a protein kinase?
- How does a protein kinase cascade work? What does it do to the original signal?
- What is the role of cyclic AMP or calcium ions in signal transduction?
- What does a cell do when it receives a signal? Specifically, what kinds of cellular processes are altered upon receipt of a signal?

Project Details:

Using pictures, diagrams, and words, *you and a partner* will create a poster that investigates a specific cell communication pathway. In order to get information on a variety of examples of cell communication, select your first, second, and third choices. I will do my best to give you your first choice, but not all students can do the same pathway.

Topic Choices:

1. Cell Cycle Regulation and Cancer
2. Hormone/Receptor - Insulin and Diabetes
3. Hormone/Receptor - Adrenaline and Stress
4. Hormone/Receptor – Testosterone and Development of Maleness
5. Nerve/Neurotransmitters – Parkinson’s Disease
6. Nerve/Neurotransmitters – Pain Medication and Addiction
7. Nerve/Neurotransmitters – Myasthenia gravis
8. Immune Response - HIV infection
9. Immune Response – B cell and antibody recognition & memory
10. Immune Response – T cell recognition & memory
11. Plant Responses – Etiolation (greening)
12. Plant Responses – Fruit Ripening (ethylene mediated)
13. Plant Responses – Flowering (phytochrome mediated)

SPECIFIC CRITERIA:

- Use a tri-fold science fair type poster board. It is thicker than regular poster board material. It is preferable that you find one that is divided into thirds (hence tri-fold).
- All information must be typed. All information must be broken down into sections.
 - Introduction – Provide context for your project. Address information for each bullet point listed for general background information.
 - Specific Information – Describe your specific cell signal pathway. **Include a diagram of this pathway.**
 - A Faulty Signal Pathway – Describe what happens if the pathway does not work properly. Is there is specific disease or disorder that results?
 - Symptoms – Describe the symptoms seen in the organism if the pathway is not functional.
 - Literature Cited - List all references used in correct format. This should be in the bottom left hand corner. References must be in 14-point type and fit on an 8.5 X 11” piece of paper. You must include a minimum of five (5) sources.
- Each section should have a title that is 84-point type or 1.5 inches. Use a font that is easy to read. The text should be at least 14 points in size. (You can have more than one page per section if necessary.)
- You must include at least 3 graphics. The minimum size is 8.5 X 11”, in order to be easily seen. One of the graphics must be a picture or drawing of the type of cell signaling pathway(s) involved. The other two graphics may be of your own choice.
- Your names should be in the bottom right-hand corner in 30-point type.

Here are some good places to start:

<http://fig.cox.miami.edu/~cmallery/150/memb/cellcomm.htm>

http://www.case.edu/pubaff/univcomm/cell-rsch.htm?nw_view=1297178092&

http://www.biology.arizona.edu/cell_bio/problem_sets/signaling/Index.html

<http://www.biochemj.org/csb/>

<http://www.kumc.edu/gec/support>

<http://www.ygyh.org/>

<http://www.ncbi.nlm.nih.gov/omim?term=genome>

<http://medgen.genetics.utah.edu/photographs.htm>

<http://www.genome.gov/>

http://www.cellsignal.com/reference/kinase_disease.html

<http://www.web-books.com/MoBio/Free/Chap6.htm>

<http://www.dnalc.org/resources/3d/cellsignals.html>

http://en.wikipedia.org/wiki/Cell_signaling

You can also use books and journals in the library to find information.

The DUE DATE for your posters is: _____

You will not be presenting your poster, but we will have a gallery walk and students may ask the authors questions if they need clarification or help understanding a particular pathway. ALL STUDENTS are expected to understand one pathway from each the of Human Systems: Nervous, Endocrine, and Immune.